

XSEDE: Tackling Diversity and Inclusion in Advanced Computing

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Digital technologies underpin, accelerate, and enable new and transformational research in all domains. The Extreme Science and Engineering Discovery Environment (XSEDE), an NSF-funded project, supports the productivity of a growing community of scholars, researchers, and engineers by providing access to advanced digital services to support open research. In addition to software, computational, and storage resources, XSEDE provides extensive user services, training, and outreach.

Led by the National Center for Supercomputing Applications (NCSA), XSEDE is a virtual organization with more than seventeen partners providing technical and management expertise. Strategic goals of XSEDE include preparing the current and next generation of scholars, researchers, and engineers in the use of advanced digital technologies and extending use of these services to new communities. XSEDE's Broadening Participation (CEE-BP) program, led by the Southeastern Universities Research Association, supports these goals by raising awareness of the value of advanced digital research services and recruiting users from new communities.

In the first six years, underrepresented minorities (URMs), women, and Minority Serving Institution (MSI) faculty and student researchers increased at a rate of 1,000 new users per year. This count only includes users who actively accessed XSEDE-managed resources as Principle Investigators (PIs) or as members of project teams. A large number of these new users persist in their engagement by participating in training workshops, presenting at conferences, serving as champions, and continuing to use resources for research and teaching. At the heart of the CEE-BP's success in increasing access and usage by URMs, women, and MSI faculty and students is the XSEDE-wide commitment. The recruitment and retention of URM, women, and MSI users are XSEDE Key Performance Indicators. While CEE-BP leads the charge and develops the strategies, XSEDE's Senior Management Team and the entire XSEDE team are engaged in creating an open and inclusive environment.

CEE-BP primarily interacts with potential users and new communities. For first-time users to be successful, they need training, practice, user support, and software tools and environments that allow them to rapidly join the community and become productive. XSEDE offers in-person training events, webinars, and multiday institutes, as well as on-demand training materials. CEE-BP leverages the XSEDE training resources to organize regional and campus in-person hands-on workshops. A significant number of potential users come from fields in which advanced compu-

ting has not been historically been used, making XSEDE New User training one of the most important sessions we offer. New User training acclimates them to navigating the XSEDE User Portal and includes an introduction to tools, gateways, and simpler access mechanisms.

Individual consulting, a popular aspect of our campus visits and workshops, provides the opportunity for participants to sign up for individual or group consulting sessions and many times results in the researchers submitting requests for access to XSEDE-managed resources. These sessions focus on the domain-specific needs of a researcher or group of researchers or educators. Consulting sessions provide for a more in-depth and personalized discussion of the researcher's needs and guidance on how to best meet those needs, including the most appropriate resources for their research.

The close collaboration between CEE-BP and XSEDE Student Programs created the Advanced Computing for Social Change Institute, which debuted in 2016. The program recruits undergraduate and graduate students from diverse majors and backgrounds to engage in a four-day, transformative leadership experience. During the institute, students learn how to use data analysis and visualization to identify and communicate data-driven policy solutions to pressing social issues. Beginning in 2018, this program will be part of the student program of the International Conference for High Performance Computing, Networking, Storage, and Analysis (known as SCXX).

Relationship building is a cornerstone of CEE-BP's success, starting with in-person campus visits. To promote the value of computational and data science curriculum and use of advanced computing in research, we exhibit at conferences and visit institutions that serve large populations of URM and female students or have active broadening participation in STEM programs. Before each campus visit, we work with local representatives to understand the institution's strategic goals, develop a visit agenda, and identify who we need to meet in order to garner campus-wide interest and leadership buy-in. CEE-BP draws the most appropriate XSEDE technical consultants, education staff, and champions who connect with the audience to participate in the visit.

To create persistent engagement by new communities and at institutions where digitally enabled research is not the norm, a strategy that promotes an institutional culture shift is necessary. The XSEDE Education program focuses on the broad adoption of computational thinking and data analytics into the research practice and curriculum at institutions. Many institutions, especially MSI and undergraduate, have not integrated the modeling and simulation concepts into their curriculum and their faculty need guidance on the pedagogy and tools associated with such an effort. Through the collaboration between the CEE-BP and XSEDE Education programs, many MSI faculty have participated in education workshops and updated their courses. New Mexico State University created a computational engineering program, and Morgan State University updated courses, created several new courses, and developed their curriculum plan for a computational science minor.

CEE-BP works closely with the external evaluators who develop instruments that capture feedback and outcomes from every interaction and event. The evaluation tools and support have helped us refine our campus visit agendas and increase the relevance of the training we deliver. CEE-BP is continually evolving. Originally we tracked the number of new users; now we track both new and persistent users. The first training workshops focused heavily on programming and command line interfaces; our current workshops focus on software tools, gateways, and simplified access to get the job done. As advanced computing evolves, domains outside of STEM embrace data science, and researchers tackle new challenges, CEE-BP will continue working with the external evaluators and the other members of the XSEDE team to ensure that we are truly connected with the communities we serve, are increasing MSIs' capacity for digitally enabled research, and fostering an inclusive research computing ecosystem.

ABOUT THE AUTHOR

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